WHAT IS CLAIMED IS:

1. An apparatus for sampling and preparing gaseous matter with entrained particulate matter for analysis, the apparatus comprising:

a device for producing a low pressure plasma, said device having a particle input port configured and disposed for receiving particles to be analyzed;

a momentum separator having a particle exit port configured for releasing a beam of particles and connected in communication with said particle input port of said device, said momentum separator having a particle entrance port connected in communication with said particle exit port; and

a conduit having an exit opening connected in communication with said particle entrance port of said momentum separator, said conduit having an entrance opening connected in communication with said exit opening and configured and disposed to receive particles to be analyzed, said conduit being configured to transport therethrough the particles from said entrance opening to said exit opening and wherein said conduit includes a restrictive flow portion having an effective flow diameter in the range of about 0.5 to 4.0 millimeters and disposed between said entrance opening and said entrance port of said momentum separator.

2. An apparatus as in claim 1, wherein said device for producing a low pressure plasma is a glow discharge unit

3. An apparatus as in claim 1, wherein said device for producing a low pressure plasma is configured and disposed for receiving particles to be analyzed in a sampling region at a first pressure in the range of 0.1 torr to 10.5 torr.

4. An apparatus for sampling and preparing gaseous matter with entrained particles for analysis, the apparatus comprising:

a momentum separator having a particle entrance port configured for receiving an input of gaseous matter with entrained particles, said momentum separator being configured for removing the particles from the input of gaseous matter with entrained particles, said momentum separator having a particle exit port connected in communication with said particle entrance port and configured for releasing a beam of particles, said momentum separator being configured and disposed for removing at least one gaseous component from the input;

a conduit having an exit opening connected in communication with said particle entrance port of said momentum separator, said conduit having an entrance opening connected in communication with said exit opening and configured and disposed to receive an input of gaseous matter with entrained particles and transport the input from said entrance opening to said exit opening; and

an instrument configured and disposed for analyzing said at least one gaseous component.

5. An apparatus as in claim 4, wherein said instrument includes a glow discharge unit.

6. An apparatus for sampling and preparing gaseous matter with entrained particulate matter for analysis, the apparatus comprising:

a glow discharge unit having a particle input port configured and disposed for receiving particles to be analyzed and providing energy that ionizes and excites the particles in a sampling region;

a momentum separator having a particle exit port configured for releasing a beam of particles and connected in communication with said particle input port of said glow discharge unit , said momentum separator having a particle entrance port connected in communication with said particle exit port;

a first instrument configured and disposed for analyzing the atomic emission from said sampling region of said glow discharge unit; and

a second instrument configured and disposed for mass spectrometric analysis of particles from said sampling region of said glow discharge unit.

7. An apparatus as in claim 6, wherein said first and second instruments are configured and disposed for performing simultaneously on the particles from said sampling region of said glow discharge unit, atomic emission analysis and mass spectrometric analysis.

8. An apparatus as in claim 6, further comprising:

a third instrument configured and disposed to obtain information about the size distribution of the particles in the particle beam, said third instrument being disposed to operate on the particle beam before the particle beam enters into the glow discharge unit.

9. An apparatus as in claim 8, wherein said third instrument comprises a low-power laser scattering device.

10. An apparatus as in claim 6, wherein said momentum separator includes a chamber connected to a pump, and the apparatus further comprises at least a third instrument and an auxiliary bleed line, said auxiliary bleed line being connected in communication with said pump, said third instrument being configured and disposed for analyzing the gases drawn into said auxiliary bleed line.

11. An apparatus as in claim 10, wherein said third instrument includes a second glow discharge unit.

12. An apparatus as in claim 10, wherein said third instrument is configured and disposed for analyzing the atomic emission from the gases drawn into said auxiliary bleed line.

13. An apparatus as in claim 10, wherein said third instrument is configured and disposed for performing mass spectrometric analysis of the gases drawn into said auxiliary bleed line.

14. A method for sampling and preparing gaseous matter with entrained particulate matter for analysis, the method comprising:

using a conduit to generate and transport a stream including particulate matter to the entrance port of a momentum separator

wherein said conduit has an entrance opening and a restricted flow portion having an effective flow diameter in the range of about 0.5 to 4.0 millimeters and disposed between said entrance opening and said entrance port of said momentum separator;

using said momentum separator to provide a beam containing particulate matter to be analyzed;

providing particulate matter in the beam into a device for producing a low pressure plasma; and

using said device to provide energy that ionizes and excites the particulate matter in a sampling region so that the particulate matter can be analyzed.

15. A method as in claim 14, further comprising the step of using at least one of atomic emission and mass spectrometry to analyze the ionized and excited particulate matter.

16. A method as in claim 15, wherein before said analyzing step, the ionized and excited particulate matter is collected in situ in said sampling region until a sufficient amount of the ionized and excited particulate matter is available for performing said analyzing step.

17. A method as in claim 14, further comprising the step of analyzing the ionized and excited particulate matter by simultaneously performing atomic emission analysis and mass spectrometry analysis on the ionized and excited particulate matter.

18. A method as in claim 17, wherein before said analyzing step, the ionized and excited particulate matter is collected in situ in said

sampling region until a sufficient amount of the ionized and excited particulate matter is available for performing said analyzing step.

19. A method as in claim 14, further comprising the step of:

before providing the particulate matter in the beam into said glow discharge unit, subjecting the particulate matter to particle sizing analysis.

20. A method as in claim 19, wherein said analysis of ionized and excited particulate matter is effected using at least one of atomic emission and mass spectrometry.

21. A method as in claim 19, wherein said sizing analysis is effected using low-power laser scattering.

22. A method as in claim 14, wherein said stream including particulate matter also includes at least one said gaseous component and the method includes the further step of using one of atomic emission analysis and mass spectrometry analysis on said at least one gaseous component.

23. A method as in claim 15, wherein before using said conduit, the particulate matter is collected ex situ and delivered to the entrance opening of said conduit.

24. A method as in claim 17, wherein before using said conduit, the particulate matter is collected ex situ and delivered to the entrance opening of said conduit.